

ARANEOMORPHAE: Development of an application for the identification of the taxonomic key of arachnid families in Brazil

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Abstract— This study aimed to evaluate an application to support decision making in the identification process of taxonomic arachnids of families in Brazil. The device was developed by Ionic framework used to develop hybrid applications and with the help of Java Script programming language and the angular JS framework. With convenience, speed, easy handling and low cost maintenance, the digital system called for their Araneomorphae authors is an App (Application) and this digital system, professionals and lay people will perform clearly and dynamic identification and classification of specimens arachnids, reducing the time to research and understanding of their taxonomy. To review the application, a taxonomic key was used containing the figure of six Brazilian arachnids for identifying a period of 30 minutes. Were invited 200 students from five undergraduate classes in Biological Sciences from the Lutheran University Center Palmas - CEULP / ULBRA, Tocantins state for the key printed taxonomic, the vast majority of students (81%) took more than 30 minutes to identify the six species, whereas with application usage, 91.3% of identified species of arachnids in less than five minutes. The application proved practical, easy to understand and use, and can assist in supporting decision making to identify and rank the most common early specimens of arachnids.

Keywords— Araneomorphae; Digital application; Taxonomic key.

I. INTRODUCTION

Taxonomy is the science that identifies and sorts animals and plants, according to its anatomic and

morphological structure. This theory classifies and separates the specimens in research through predetermined data from previous studies by other researchers. ARAÚJO; Bossolan, 2006; GOMES, 2007; Ferraz; BELHOT, 2010; Rapini, 2004; VASCONCELOS, 2003) According Martins (1994) and BRITO (2012) There is variety in the animal world, with more than 1 million and 500 thousand known species, and this restricts professional zoologists as to one or a few fields of interest in research.

In each animal group or type of research there are specific peculiarities in the capture or collection of material for preservation or for access to collections. To identify the specimens, the Taxonomy is the use of bases and predetermined principles by morphological anatomy of the object under study, which may be an animal or plant that has identification orders and classification based on taxonomic keys and private or public collections. Your goal is to guide the identification of a particular species (Martins & CAMPOS, 1994; GOMES, 2007).

Taxonomy comprises observing, classifying and sorting as previously established norms. These orders can be seen in the collections of museums, research materials such as taxonomic keys and references to anatomy of the study in question. Thus being able to classify - acquire information of the group or groups of objects, according to the goals you want to achieve.

The identification of an arachnid, for many researchers, requires a bibliography in text format in most of his work in the field or in the laboratory, however, not to experts, it is a difficult and often frustrating task. In

practice, arachnids identification is more complicated due to factors such as the existence of a huge number of different species; macro and microscopic variety of specimens; the lack of biological information of many species and the diversity of the Brazilian territory.

Although the preparation of identification keys comprises one among the numerous activities carried out by taxonomists, students of biological sciences and agricultural sciences or are generally not experts confronted by truly difficult to interpret key due to technical terms and the need for illustrations and images reduce the cognitive and interpretive time in a printed publication. In arachnids, biotic and abiotic factors may compromise their analysis, the most common biotic factors would be the loss of limbs such as legs, chelicerae or spinners or eyes, disputed territories, attacks by predators, abiotic factors cause influences on living organisms through physical aspects, chemical or physical chemical environment such as light, temperature, wind or weather scheme, to the action of the researcher collects as a wrongly performed, or even the preservation of these acids in liquid specimens.

The identification by means of certain keys in text format can be compromised due to these factors in the sense that the key taxonomic printed, is usually "monothetic" (Martins, 1994). When it says that the key is monotética means that it employs a unique combination of characters,

with necessary and sufficient criteria to identify a particular taxon. Or otherwise in the specimen to be identified, missing the diagnosis character, the key becomes confused and useless. This is unfortunately a very common occurrence; in insects, for example, the fall of a bristle, an antenna, or perhaps a leg, make it difficult to identify through certain keys. The expert, although to know the group, you may possibly identify him, the "gist" (Martins, 1994). In this sense, it was proposed this study aimed at evaluating a digital key named Araneomorphae, key arachnids for Families Taxonomic identification of Brazil.

II. MATERIAL AND METHODS

The digital system APP (application) was produced by making use of illustrated images of the identification key for Families spiders Brazilian Taxonomic, the Brescovit authors, Rheims and BONALDO researchers Arthropods Laboratory of the Butantan Institute, Sao Paulo capital, obtained through print the site presented in the bibliographic reference of this work. Images were separated according to their own taxonomy of specimens illustrated in print key. With short questions the researcher can identify the order of arachnids by their morphological anatomy as shown in Figure 01.

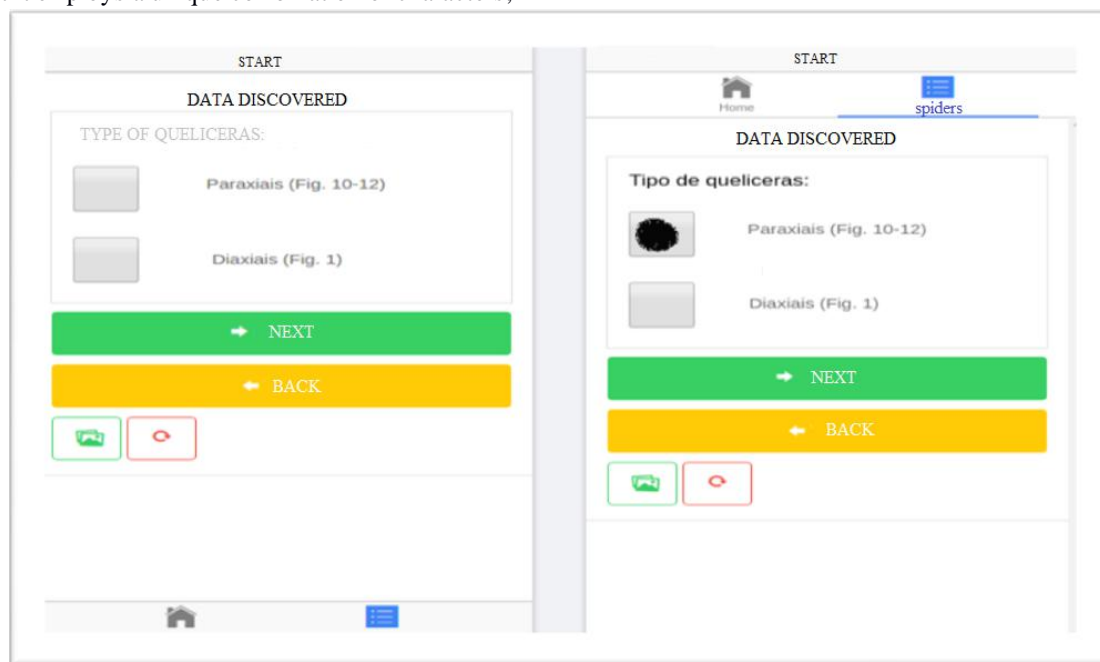


Fig.1: Alternatives to the morphological taxonomic choice of chelicerae.

When choosing the type of morphology chelicera, users have the answer of the arachnid order and up to three images listed following the pattern of a printed key. They

can compare them with the specimen under study. Having up to three options illustrated pictures to make the diagnosis as in Figure 2.

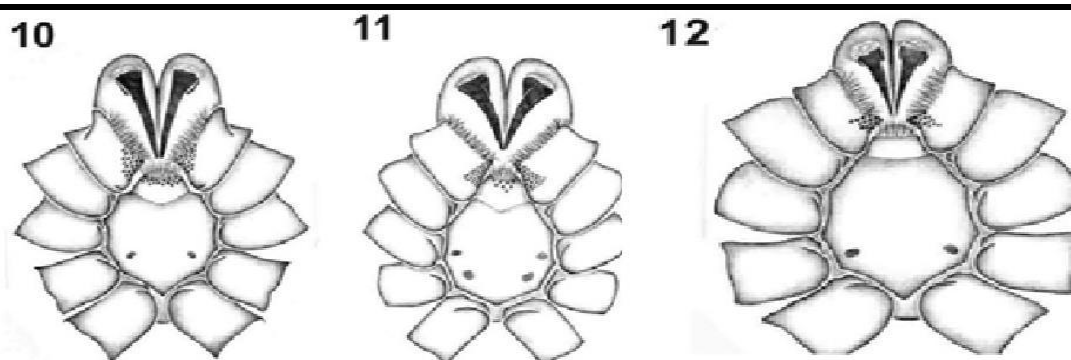


Fig.2: Orders spiders identified by morphological taxonomy of chelicerae.
Source: Key to families of spiders Brazilian Taxonomic 2018.

The nomenclature code Zoological (ASH) was used to regulate the names of taxa of the group of families, tribes, genera and species. The names of the taxa can be single-member, binomial, trinomial and tetranominal (Bernadi, 1994). Through a framework called ionic used for the development of hybrid applications. Specimens were sampled in the entomological collection represented by illustrations or photographs taken or adapted from other sources, being duly cited. They were initially developed the layout (assign software) and topics to be addressed in this. The home screen consists of the main items: Introduction, External Morphology, identification keys and credits. To develop the layout and access buttons was used HTML and CSS.

The resolution of the layout has been configured so that it suits smartphone size used, avoiding undesirable distortions in the display and arrangement of images on the screen. With the help of JavaScript programming language and the angular framework JS, it developed the system for playback and operation of identification keys and other itemized above. This was chosen due to the fact be an actual language, to be constantly updated and also work on all platforms, both browsers, but also on mobile devices.

III. RESULTS AND DISCUSSIONS

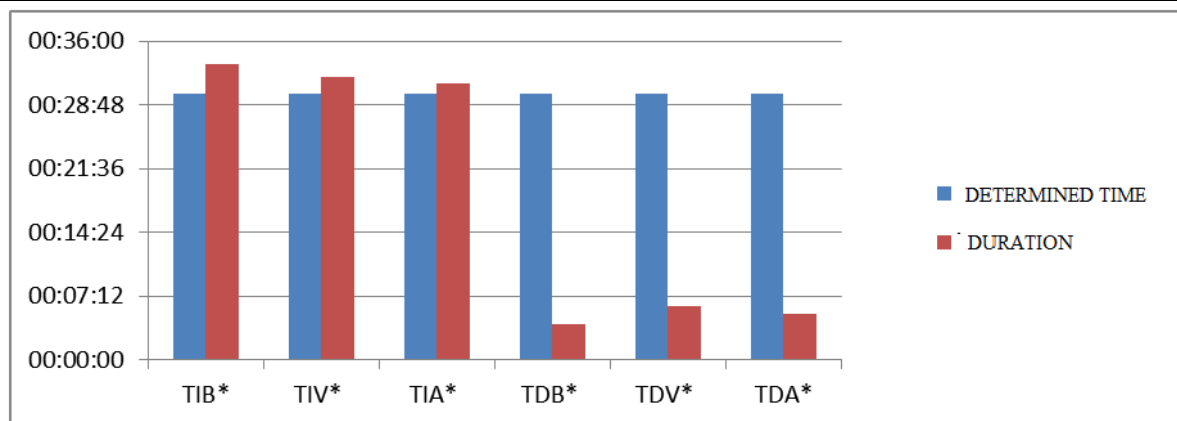
The arachnids identification digital system in Brazil presents a Brazilian and international bibliographies analysis study of spider families, select images and arachnids illustrations, already described good quality technical and visual, fast and low cost, developed a methodology agile and easy to handle for arachnids identification perfecting data of arachnids families of printed keys, for use in various off-line software platforms, with a software platform with easy upgrade and maintenance for the creation of digital identification system arachnids illustrating the taxonomic identification of arachnids of families with more common occurrence in

Brazilian ecosystems. It was used as the zoological theoretical basis for the following production of the APP (Application).

The nomenclature consists of a system of names applied to taxa animals - is governed by the International Code of Zoological Nomenclature (ICZN, 1985); by a system of rules and recommendations about the proper way to compose and apply the zoological names (Bernadi, 1994). According Bernadi (1942), the zoological nomenclature code (ASH), is intended to "promote stability and universality of the scientific names of animals, and to insure that the name of each taxon is unique and distinct." In other words, the code you want each animal taxon has a unique name, distinct, stable and universal. In this sense, the digital system reduces the possibility of the researcher to make mistakes in the investigation, at the time point of an assignment to a particular specimen, the specimen to be diagnosed.

APP (Application) was evaluated in five classes with 40 students of their undergraduate degrees in Biological Sciences, Agronomy and Veterinary totaling 200 students from the Lutheran University Center Palmas - CEULP / ULBRA, Tocantins state. It was presented to the students six specimens of Brazilian arachnids, with its morphological anatomy described. Orientou- that each of the identified mites in a given period of 30 minutes using a taxonomic key printed. With the same students at another time, we were presented six new images of Brazilian arachnids. At this point, it was requested that each student identify each arachnid using the Application.

Students who used the printed taxonomic key, identified arachnids above the appointed time of 30 minutes when performed using the application time duration to identify the animals was lower, at just 5 minutes performed the classification of arachnids. Students identified in less than 30 minutes as shown in Figure 3.



Note: TIB * Analysis time with print / Biology; TIV * Analysis time with print / Veterinary; TIA * analysis time with print / Agronomy; TDB * Analysis time with application / Biology; TDV * Analysis time with application / Veterinary; TDA * Analysis time with application / Agronomy.

Fig.3: Arachnids identification time between digital and printed methodologies.

The researcher who is in the field or in the laboratory gets a quick and reliable response to your search saving time. Avoiding capture and contain these animals to better understand through other taxonomic keys for the lack of agility and good understanding of the

technical terms of a printed key reducing the death of the majority of the specimens contained for study. For information purposes it is observed in Figure 04, the application's main menu.

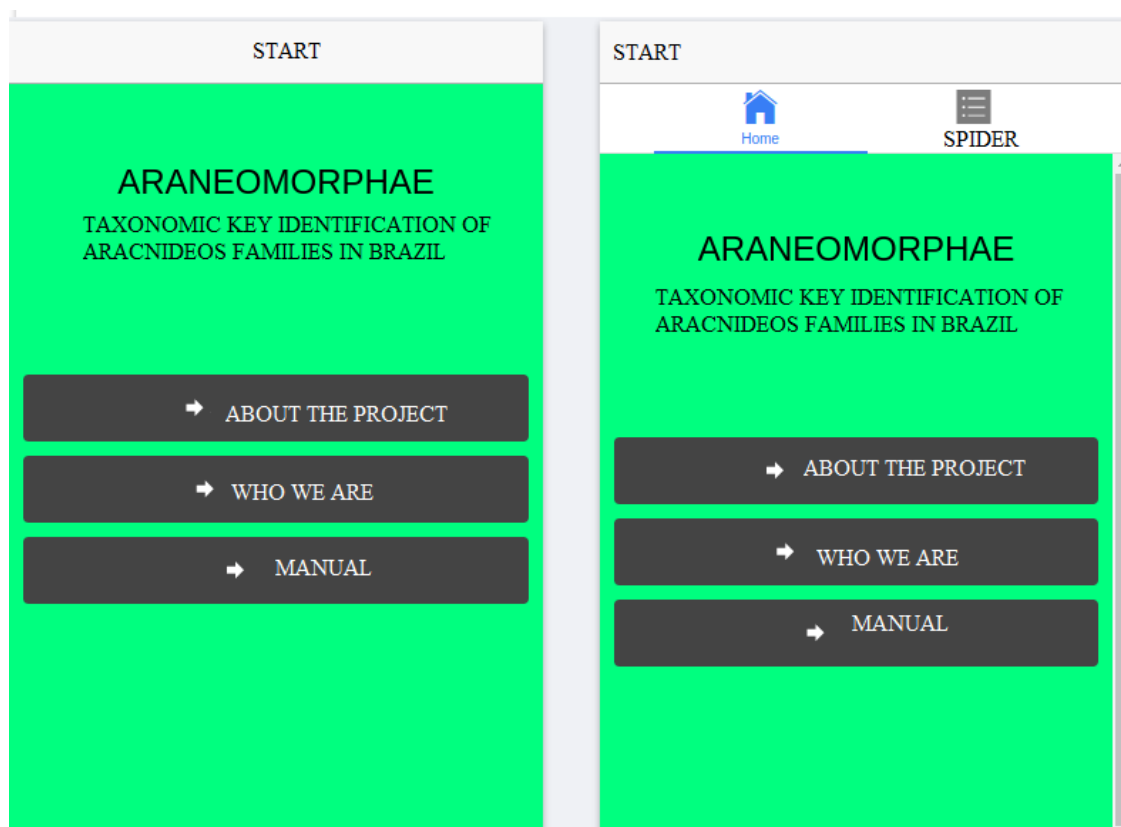


Fig.4: General data about the application.

IV. CONCLUSION

Based on research conducted, few available examples of interactive keys and taxonomic keys in printed and published in Brazil, either through the internet, or by other digital media, highlighting the

shortage of professionals, a fact that further limits development of this work.

The developed system needs some changes and corrections, but preliminary tests showed no problem of implementation and operation. Future prospects seek the

inclusion of a greater number of families together with a brief description of the same, obtaining images of the main species and other software to identify causative arachnids properly identified pests in a reference collection for availability and distribution through internet application format (still in research). Tests conducted with undergraduate students were very conclusive, demonstrating the need and the importance of technology to zoology and systematic taxonomy, as a training tool for learning and the study of knowledge and arachnids systematic taxonomy of Brazil.

It is expected that, given the scarcity of studies on identification keys for use in digital appliances in Brazil, new jobs are carried out, spreading new tools and methodologies to assist in the identification process. The digital system APP (application), proved to be easy to maintain and use and can be used by professionals and non-professionals including the areas of Life Sciences and Agricultural Sciences. It is free available its first version in Google Play.

REFERENCES

- [1] ARAÚJO, A. P. U. DE; BOSSOLAN, N. R. S. **Noções de Taxonomia e Classificação Introdução à Zoologia**. [s.l: s.n.]. v. 2
- [2] BERNADI, Nelson, 1942. **O Código Internacional de Nomenclatura Zoológica adotado pelo xv Congresso Internacional de Zoologia, Londres, Julho de 1958**. (Coleções, Bibliografia, Nomenclatura). – 2 ed. rev. e ampl- São Paulo: Editorada Universidade Estadual Paulista, 1994 – (Natura naturada). Disponível em:
- [3] BRESCOVIT, Antonio D.; RHEIMS, Cristina A.; e BONALDO, Alexandre B. **Araneomorphae, Chave de identificação para Famílias de aranhas Brasileiras Taxonômicas** - Laboratório de Artrópodes, Instituto Butantan, São Paulo, SP; Departamento de Zoologia, IB/USP, São Paulo, SP; Museu Emílio Goeldi, Belém, PA. Disponível em: <<https://pt.scribd.com/document/123853696/Chave-de-Familias-de-Aranhas> >>. Acesso em: Jan. 2018.
- [4] BERNADI, Nelson, 1942. **Nomenclatura Zoológica**: (Coleções, Bibliografia, Nomenclatura). – 2 ed. rev. e ampl- São Paulo: Editorada Universidade Estadual Paulista, 1994 – (Natura naturada).
- [5] BRITO, C. H. Modelagem didática tridimensional de artrópodes, como método para ensino de ciências e biologia. **Revista Brasileira de Ensino de Ciência e Tecnologia**, v. 5, n. 3, 20 dez. 2012.
- [6] CAMPOS, M. L. DE A.; GOMES, H. E. **Taxonomia e Classificação: a categorização como princípio**. VII ENANCIB - Encontro Nacional e Pesquisa em Ciência da Informação. **Anais...**2007Disponível em: <<http://www.enancib.ppgci.ufba.br/artigos/GT2--101.pdf>>. Acesso em: 3 jun. 2018
- [7] FERRAZ, A. P. DO C. M.; BELHOT, R. V. Taxonomia de Bloom: revisão teórica e apresentação das adequações do instrumento para definição de objetivos instrucionais. **Gestão & Produção**, v. 17, n. 2, p. 421–431, 2010.
- [8] RAPINI, A. Modernizando a taxonomia. **Taxon**, v. 4, p. 1–4, 2004.
- [9] VASCONCELOS, E. G. DE. Revisão taxonômica de *Mischonyx Bertkau*, 1880 (Opiliones : Laniatores : Gonyleptidae). 2003.
- [10] MARTINS, Ubimjara R. **Tipos de publicações Zoológicas**. In: PAPAVERO, Nelson, 1942 (Org.). **Fundamentos Práticos De Taxonomia Zoológica: (Coleções, Bibliografia, Nomenclatura)**. – 2 ed. rev. e ampl- São Paulo: Editorada Universidade Estadual Paulista, 1994 – (Natura naturada).
- [11] PAPAVERO, Nelson; MARTINS, Ubimjara R. **Itens da Publicação Taxonômica**, Cap.04. In: PAPAVERO, Nelson, 1942 (Org.). **Fundamentos Práticos De Taxonomia Zoológica: (Coleções, Bibliografia, Nomenclatura)**. – 2 ed. rev. e ampl- São Paulo: Editorada Universidade Estadual Paulista, 1994– (Natura naturada).